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Title: REVIEW OF Ya. I. FRENKEL'S 'PRINCIPLES OF THE THEORY OF THE ATOMIC
NUCLEI' USSR

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CONFIDENTIAL**REVIEW OF Ya. I. FRENKEL'S 'PRINCIPLES OF THE THEORY OF THE ATOMIC NUCLEI'****G. B. Zhdanov**

(NOTE: The following is an abstract of a review, by G. B. Zhdanov, of Ya. I. Frenkel's book Printsipy Teorii Atomnykh Yader, published 1950 in Moscow and Leningrad by the Academy of Sciences USSR Press; 296 pages, 14.50 rubles, and 5000 copies. This review appeared in the 'Physics and Mathematics Review' section of the journal Sovetskaya Kniga, April 1951, pages 14-17.

In the first part of the review the reviewer points out the defects of the book, in the manner required of all true adherents of communism (criticism, even self-criticism, to detect shortcomings is a very important concept in Soviet life). In the second part he finally describes the book's subject matter in the order of appearance in the book, with critical comments.)

Frenkel has posed the problem of acquainting the ordinary physicist or engineer with the main properties of nuclear and elementary particles and gives the key to the understanding of the most important nuclear processes - namely, nuclear reactions and radioactive transformations. Considerable space is also given to a description of the structure of stable nuclei (mainly in the appendix).

Although the book being reviewed is written on the basis of a course of lectures delivered by the author it does not meet with the author's intended purpose of a fairly popular book for readers of moderate scholastic background. Apparently this shortcoming is connected with the tendency of the author to utilize original matter, in itself very valuable but insufficient for a systematic exposition of the subject.

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Another defect in the book is that the author overlooks the necessity of orienting the readers with more or less definite levels of preparatory material, although he tries to mitigate this defect with asterisks, by which he tags the more difficult sections in the book. For example, the author glibly discourses on the most complex problems in the theory of elementary and compound particles, whose formulation requires a much greater scientific outlook than the elementary knowledge of atoms and electrons assumed to be possessed by his readers. Even the mere stating of some problems requires lengthy preliminary explanations.

Chapters I and II consist mainly of : preliminary information of very diverse character; a description of the nuclear model of the atom with a methodical investigation of nuclei with the aid of fast charged particles; an exposition in the theory of solids and fluids; a treatment of the problem of the internal energy of elementary particles; a description of the general properties of elementary particles; and an explanation of spin and the nature of statistics. In these two chapters the author acquaints the reader with the original ideas of ordinary wave mechanics and the more recent quantum electrodynamics. He also reports the present-day problems in the creation of a relativistic quantum theory of complex particles and the quantum-field theory of elementary particles.

Chapter III, taking up the main theme of the book, begins with a description of the general properties of the nuclei and a very fruitful model of the nucleus as a fluid drop and then passes over to a descriptive representation of the nature of elementary interactions of nucleons in the nucleus. The author successfully applies the so-called method of the self-concordant field to the study of the structure of heavy nuclei and to the analysis of the energy balance of stable nuclei.

The following chapters gives a successful easily understandable qualitative and quantitative explanation of spontaneous fission and alpha-decay of heavy nuclei on the basis of the tunnel effect. More specifically:

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Chapter V contains mainly descriptive matter on beta and gamma radioactivity (natural and artificial) and on nuclear fission. Considerable attention is directed toward the processes occurring in the atomic bomb.

Chapter VI is devoted to an investigation of the nuclear reactions involved in the transformation of heavy nuclei under the action of incident particles, using a thermodynamic method of analyzing the excited states of the nucleus. It is also devoted to the solution of the problem on effective cross sections and resonance phenomena in reactions according^{to} the model of a complex nucleus and general wave-mechanical representations. Ya. Frenkel¹ does not show any quantitative application of these methods to cosmic rays, to the analysis of nuclear decay from the point of view of the theory of "nuclear evaporation", or to nuclear reactions (for example, the general behavior of effective cross section for neutrons as a function of their energy).

Chapter VII discusses the peculiarities and kinetics of nuclear reactions occurring in very hot stars, and the role of these reactions for the energy balance and stellar evolution. The author leaves his main theme, when he expounds on the problem of gravitational contraction in stars.

In the appendix, the author, for some unknown reason, leaves problems that are very close to the main theme of the book: the theory of the deuteron and the analysis of the collision of two nucleons; that is, problems closely connected with the study of the laws of elementary interaction of nuclear particles, and also the analysis of the periodic regularities observed by the properties of the atomic nuclei and their treatment from the statistical point of view.

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